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SUMMER HOLIDAY HOMEWORK

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CLASS - 12 (2026-27)

Competency Focused Practice Questions

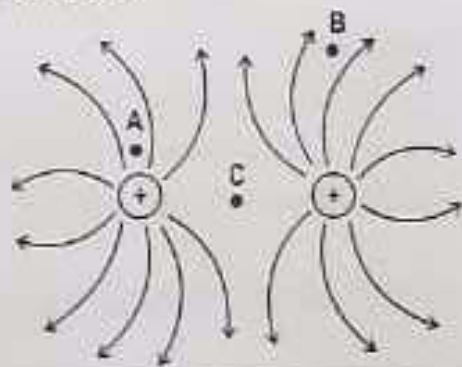
Physics (Volume 1) | Grade 12



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CLASS - 12 (SESSION-2026-27)
SUMMER HOLIDAY HOMEWORK

Chapter: Electric Charges and Fields & Electrostatic Potential and

Q.No	Question	Marks
Multiple Choice Question		
Q.1	Two insulated rods have opposite static charges at their ends. The charged rods are mounted at their centres so that they are free to rotate in the plane of the screen. The two rods can be held in the following 4 orientations as shown below.  P  Q  R  S Identify which of these orientations are stable such that they return to their original orientation if slightly displaced. A. Orientations P and Q are stable. Orientations R and S are unstable. B. Orientations Q and R are stable. Orientations P and S are unstable. C. Orientations Q and S are stable. Orientations P and R are unstable. D. Orientations P and R are stable. Orientations Q and S are unstable.	1
Q.2	Electric field lines are pictorial representations of electric fields due to static charges on the plane of a paper. 	1

building from lightning by either neutralizing or conducting the charge of the cloud in the sky to the ground.



Identify ONE statement from below given that DOES NOT contribute to the correct explanation of the working principle of a lightning conductor.

- A. Charge density on the surface of metal spikes is inversely proportional to the radius of curvature.
- B. Charges are distributed uniformly on the surface of conductors irrespective of their shapes.
- C. The surface of a charged conductor behaves as an equipotential surface.
- D. Charges reside only on the outside of a charged conductor.

Q.6 Two statements are given below. One is labelled Assertion (A) and the other is labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.

Assertion (A): An electric dipole is in stable equilibrium when placed in a uniform electric field with its dipole moment opposite to the field.

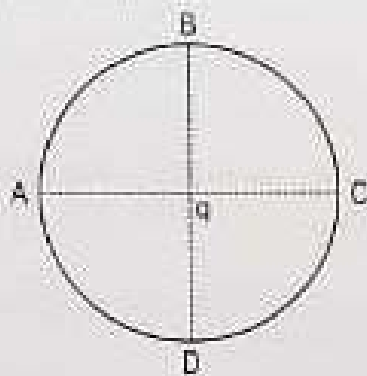
Reason (R): No torque acts on an electric dipole when its dipole moment is in a direction opposite to the field.

- A. Both assertion and reason are true and reason is the correct explanation for assertion.
- B. Both assertion and reason are true but reason is not the correct explanation of assertion.
- C. Assertion is true but reason is false.
- D. Assertion is false but reason is true.

Q.7 15 charged particles with the same charge (q) are placed on the x -axis. They are symmetrically distributed on both sides of the y -axis. The distance between any two consecutive particles is $R/3$ and one of the charges is at the origin.

What is the electric flux through a sphere centred at the origin having a radius of $1.5R$?

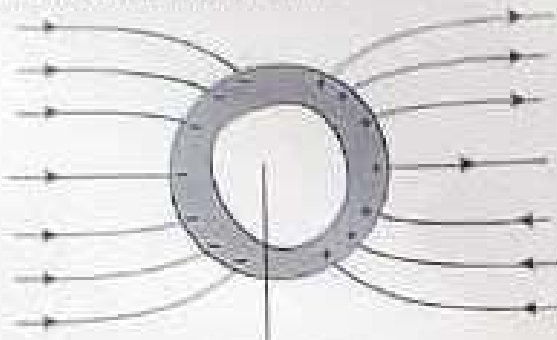
- A. $15q/\epsilon_0$
- B. $8q/\epsilon_0$
- C. $9q/\epsilon_0$
- D. $5q/\epsilon_0$

	Study the given electric field representation and identify one INCORRECT qualitative impression given by this representation. A. The electric field at point A is stronger than at point B. B. The electric field distribution is two-dimensional. C. The electric field at point C is zero. D. The electric field always points away from a positive charge.	
Q.3	For a Gaussian surface through which the net flux is zero, the following statements COULD be true. P) No charges are inside the Gaussian surface. Q) The net charge inside the surface is zero. R) The electric field is zero everywhere on the surface. S) The number of field lines entering is equal to the number of lines exiting the surface. Which of the statements is/are DEFINITELY true? A. Only statement Q. B. Both statements P and S. C. Both statements Q and R. D. Both statements Q and S.	1
Q.4	A charge $q = +2 \text{ C}$ is located at the center of a circle of radius 2 m. A unit positive test charge is moved along the circle.  Identify the correct statement. A. Work done in moving a test charge from A to C is maximum. B. Work done in moving a test charge from A to B or from A to D is minimum. C. Work done in moving a test charge from A to B to C to D is more than from A to D. D. Work done in moving a test charge between any two points along the circle is zero.	1
Q.5	A lightning conductor is made of a conducting material with one of its ends earthed while the other end has several sharp metal spikes. It protects the	1

Two small metal blocks (X and Y) of the same mass m are placed on an insulated frictionless surface such that both of them are at the same distance from the edge of the surface as shown in the image below. The charge on block X is $+100Q$ and that on Y is $+50Q$. The two blocks are held in position by an external force.



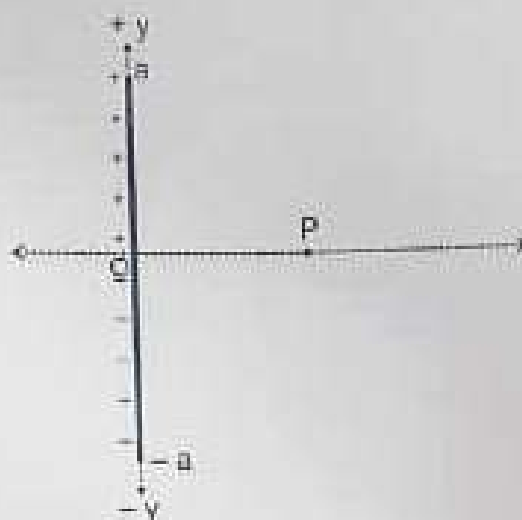
Q.8	If the external force holding the blocks in their respective positions is removed, then which of the following will happen? A. Block X will reach the edge first. B. Block Y will reach the edge first. C. Both the blocks will reach the edge at the same time. D. The blocks will NOT move from their positions.	1
Q.9	If block Y is replaced with another block Z with the same charge but mass $2m$, which of the following will happen when the external force holding the blocks in their respective positions is removed? A. Block X will reach the edge first. B. Block Z will reach the edge first. C. Both blocks will reach the edge at the same time. D. The blocks will NOT move from their positions.	1
Q.10	The two blocks X and Y are momentarily brought in contact and placed again in the same initial position as shown in the image. Which block will reach the edge first, once the external force holding them in their positions is removed? A. Block X will reach the edge first. B. Block Y will reach the edge first. C. Both blocks will reach the edge at the same time. D. The blocks will NOT move from their positions.	1
Free Response Questions/Subjective Questions		
Q.11	A positively charged ball A hangs from a string. A non-conducting ball B is brought near ball A. Ball A is seen to be attracted to ball B.	3

	Describe the motion of the ball when it is brought into contact with one of the plates.	
Q.14	A spherical Gaussian surface encloses a positive charge q. Explain with a reason what happens to the net electric flux through the Gaussian surface if - the charge is tripled - the volume of the sphere is tripled - the shape of the Gaussian surface is changed into a cuboid - the charge is moved into another location inside the Gaussian surface	4
Q.15	The electric field inside a hollow conductor placed in an external electric field is always zero as shown in the figure. This property of a conductor finds a very useful application in shielding sensitive electric equipment. Electric circuits are enclosed within metal boxes that provide shielding from external fields, thereby protecting them from external interferences.  $E = 0 \text{ N/C}$ inside cavity Given here is a hollow, electrically neutral spherical conductor. A positive charge q is suspended at its center.  Explain with an appropriate reason if this hollow conductor shields the OUTSIDE from the field produced by the point charge inside. Represent the electric field lines diagrammatically.	3

Q.16

Given is a line of charge of uniform linear density. A charge $+q$ is distributed uniformly between $y = 0$ and $y = a$ and charge $-q$ is distributed uniformly between $y = 0$ and $y = -a$.

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Explain how the direction of the resultant electric field at point P can be obtained. Represent using a vector diagram.

Q.17

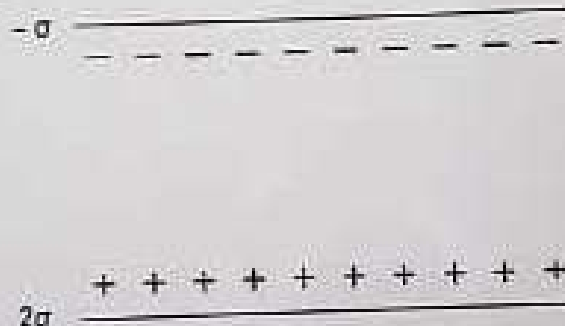
A charge of 10 C each is given to two spherical conductors A and B. The volumes of A and B are in ratio of 1:3. When A and B are connected by a conducting wire, show that it is impossible for the charge to flow from B to A.

3

Q.18

Two charged sheets having charge density 2σ and $-\sigma$ are placed parallel and close to each other in a vertical plane as shown in the figure. A particle having positive charge q and mass m is placed between these sheets and released from rest under gravity. What is the acceleration of this particle?

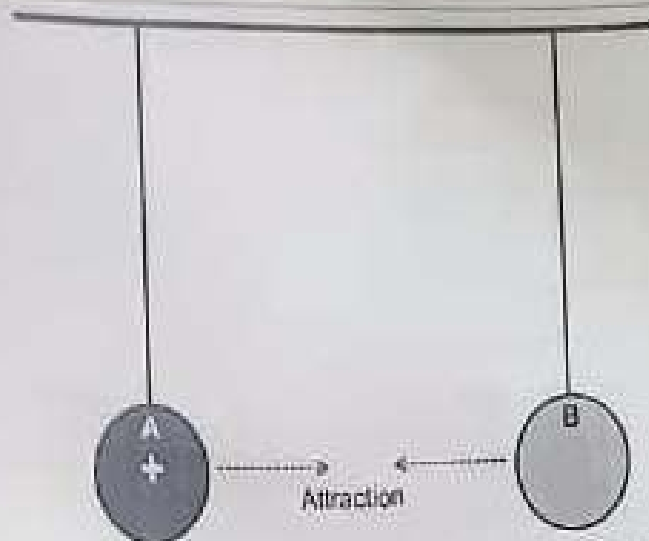
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Q.19

The figure below represents the set-up of Millikan's oil drop experiment which was used by Millikan to determine the charge on an electron. Tiny droplets of oil in the form of mist are sprayed into the chamber P. Some of these droplets pass through the small hole in the metal plate I and are ionized by X-rays in chamber Q.

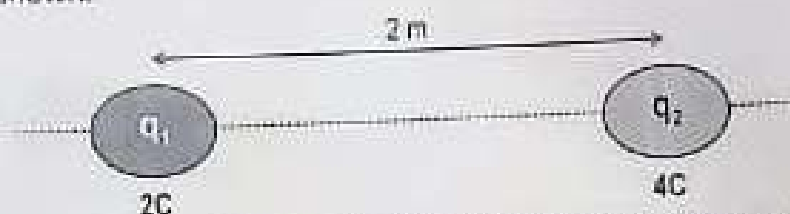
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- (a) Give reason why it is NOT possible to determine whether ball B is negatively charged or neutral for sure from the above experiment alone.
- (b) Suggest any ONE additional experiment with ball B required to determine whether ball B is negatively charged or neutral for sure.

Q.12

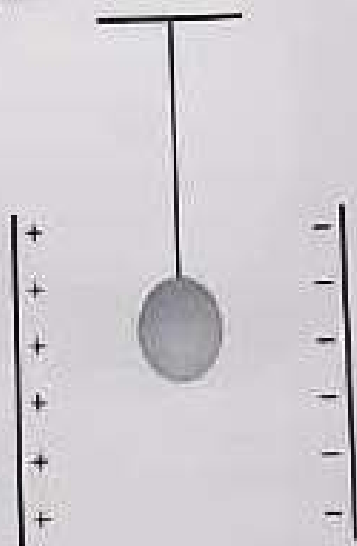
Two positive charges q_1 and q_2 lie along a straight line separated by a distance of 2 m as shown.



- (a) Find a location along the straight line joining the two charges, where if a positive charge q_3 is placed, it experiences a zero-resultant force.
- (b) Will the resultant force on q_3 placed at the location of part (a) still be zero, if it is negatively charged? Explain.

Q.13

A very small uncharged metal-coated Styrofoam ball is suspended in the region between two parallel oppositely charged metallic plates. A uniform electric field exists between the two plates.



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HOLIDAY HOMEWORK, SUBJECT : MATHEMATICS

CLASS : XII

Relations & Functions and Inverse Trigonometric Functions

MCQ

1. The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x + 4$
 - (A) Bijective
 - (B) Surjective but not Injective
 - (C) Injective but not Surjective
 - (D) Neither Surjective nor Injective
2. The value of $\cos^{-1}(-1) - \sin^{-1}(1)$ is
 - (A) π
 - (B) $\frac{\pi}{2}$
 - (C) $\frac{3\pi}{2}$
 - (D) $-\frac{3\pi}{2}$
3. Let R be a relation on the set N of Natural numbers defined by nRm if n divides m . Then R is
 - (a) Reflexive and symmetric
 - (b) Transitive and Symmetric
 - (c) Equivalence relation
 - (d) Reflexive, Transitive but not Symmetric.
4. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = x^2 + 1$, then the pre image of 10 is
 - (a) $\{3\}$
 - (b) $\{-3\}$
 - (c) $\{3, -3\}$
 - (d) $\emptyset$
5. A set A has 3 elements and a set B has 4 elements. The number of injective function that can be defined from A to B is
 - (a) 144
 - (b) 12
 - (c) 24
 - (d) 64
6. Maximum number of equivalence relation on the set $A = \{1, 2, 3\}$ are
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 5
7. The domain of the function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \sqrt{x^2 - 3x + 2}$ is
 - (a) $(-\infty, 1] \cup [2, \infty)$
 - (b) $(-\infty, 1]$
 - (c) $[2, \infty)$
 - (d) $[1, 2]$
8. The domain of the function defined by $f(x) = \sin^{-1}x + \cos x$ is
 - (a) $(-\infty, \infty)$
 - (b) $(A) [-1, 1]$
 - (c) $(B) [-1, \pi + 1]$
 - (d) $(C) (-\infty, \infty)$
 - (e) $(D) \emptyset$

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

- (a) Both A and R are true and R is the correct explanation of A.
 - (b) Both A and R are true but R is not the correct explanation of A.
 - (c) A is true but R is false.
 - (d) A is false but R is true.
9. Assertion (A): The relation $f: \{1, 2, 3, 4\} \rightarrow \{x, y, z, p\}$ defined by $f = \{(1, x), (2, y), (3, z)\}$ is a bijective function.
Reason (R): The function $f: \{1, 2, 3\} \rightarrow \{x, y, z, p\}$ such that $f = \{(1, x), (2, y), (3, z)\}$ is one-one.
 10. Assertion (A): $f: \mathbb{N} \rightarrow \mathbb{N}$ given by $f(x) = 5x$ is injective but not surjective.
Reason (R): If co-domain $\neq$ range, then the function is not surjective.
 11. Assertion (A): The relation R in the set $\{1, 2, 3\}$ given by $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3)\}$ is an

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equivalence relation

Reason (R): A relation R is said to be an equivalence relation if R is reflexive, symmetric and transitive.

12. Assertion (A): Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{a, b\}$. Then the number of surjections from A into B is 32.
Reason (R): The number of functions that can be defined from $A = \{1, 2, 3, 4, 5\}$ to $B = \{a, b\}$ is 32

13. Assertion (A): $\sin^{-1}(\sin x) = x$

Reason (R): Any value in the range of principal value branch is called principal value of that inverse trigonometric function.

14. Assertion (A): The relation $R = \{(1, 2)\}$ on the set $A = \{1, 2, 3\}$ is transitive.

Reasoning (R): A relation R on a non-empty set A is said to be transitive if $(a, b), (b, c) \in R \Rightarrow (a, c) \in R$ for all $a, b, c \in A$

VERY SHORT ANSWER

- Find the principal value of $\left(\cos \cos^{-1} \frac{1}{\sqrt{2}}\right)$.
- Find the value of $(\sqrt{3}) - (-2)$.
- Find the principal value of $\tan^{-1}(\sqrt{3}) - \sec^{-1}(-2)$.
- Let $f: R \rightarrow R$ be defined by $f(x) = \cos x$, show that f is neither one-one nor onto.

SHORT ANSWER

- Let $f: N \rightarrow N$ be a function defined as $9x^2 + 6x - 5$. Show that $f: N \rightarrow S$, where S is the range of f is bijective.
- Let T be the set of all triangles in a plane. The R is defined by $R = \{(T_1, T_2) : T_1 \text{ is similar to } T_2, T_1, T_2 \in T\}$. Show that R is an equivalence relation.

LONG ANSWER

- Let N be the set of natural numbers and R be the relation on $N \times N$ defined by $(a, b) R (c, d)$ iff $ad = bc$ for all $a, b, c, d \in N$. Show that R is an equivalence relation.
- Show that the function $f: N \rightarrow N$ defined by $f(x) = x^2 + x + 1$ is one-one but not onto.
- Let R be a relation on $N \times N$ defined by $(a, b) R (c, d)$ iff $ad(b+c) = bc(a+d)$. Show that R is an equivalence relation.
- Let $A = \{1, 2, 3, \dots, 9\}$ and R be the relation in $A \times A$ defined by $(a, b) R (c, d)$ if $a+d = b+c$ for $(a, b), (c, d)$ in $A \times A$. Prove that R is an equivalence relation. Also obtain the equivalence class $\{(2, 5)\}$.
- Show that the relation S in the set $A = \{x \in Z : 0 \leq x \leq 12\}$ given by $S = \{(a, b) : a, b \in Z, |a - b| \text{ is divisible by } 4\}$ is an equivalence relation. Find the set of all elements related to 2.

CHO

1. Consider the mapping $f: A \rightarrow B$ is defined by $f(x) = \frac{x-1}{x+2}$ such that f is a bijection. Based on the above information, solve the following questions:

(i). Domain of f is:

(A). $R - \{2\}$

(B). R

(C). $R - \{1, 2\}$

(D). $R - \{0\}$

(ii). Range of f is: a. R

(A). R

(B). $R - \{1\}$

(C). $R - \{0\}$

(D). $R - \{1, 2\}$

(iii). If $g: R - \{2\} \rightarrow R - \{1\}$ is defined by $g(x) = 2f(x) - 1$, then g(x) in terms of x is:

(A). $\frac{x+2}{x}$

(B). $\frac{x+1}{x-2}$

(C). $\frac{x-2}{x}$

(D). $\frac{x}{x-2}$

(iv). The function g defined above, is:

(A). one-one

(B). many-one

(C). into

(D). None of these